Economic analysis of the Nairobi Cancer Registry: Implications for expanding and enhancing cancer registration in Kenya

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Abstract

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Introduction—Cancer registration is an important activity for informing cancer control activities. Cancer registries in Sub-Saharan Africa have limited resources to effectively operate because of competing priorities. To date, there has not been an assessment of the resources and funding needed to perform all the activities essential for cancer registration in Kenya. Evidence will help registries to quantify and advocate for the funds needed to sustain, enhance, and expand high quality cancer registration in Kenya.

Methods—In this study, we used the Centers for Disease Control and Prevention's (CDC's) International Registry Costing Tool (*IntRegCosting Tool*) to evaluate the funding, cost, and labor resources used to perform the cancer registry operations in Nairobi County for two annual periods between July 2012 and June 2014.

Results—Funding from grants, research studies, and international organizations provided 70% of the registry operations' cost. For both time periods, the most-costly registry activities were related to administration, management, and training, along with data acquisition activities such as data abstraction, entry, and validation. Even among these core registry activities, however, substantial variations existed.

Conclusions—Stable funding for cancer registry operations is necessary to sustain core registry activities in other to deliver high-quality data, which in turn is necessary to foster evidence-based policies to improve cancer outcomes. As stakeholders look into expanding the Nairobi Cancer Registry into a national program, the cost data provided in this study will help justify the funding required for sustaining and expanding registry activities.

1. Introduction

In Kenya, cancer is ranked third as a cause of death, after infectious and cardiovascular diseases, accounting for approximately 7% of the total national mortality [1]. Although national data about cancer are not available, GLOBOCAN estimates that approximately 41,000 new cases of cancer occurred in Kenya in 2012, with 28,453 deaths [2]. The overall cancer incidence rate was 167.2 per 100,000 for men and 196.6 per 100,000 for women [2]. In low and middle income countries (LMIC), the problem of rising cancer rates is compounded by poor prevention, lack of early detection, and health care facilities that could lead to early treatment interventions.

Timely dissemination of cancer surveillance data to the policy makers and scientists responsible for designing, implementing, and evaluating cancer prevention and control activities is vital [3]. Population-based cancer registries collect information on cancers in a defined population; these data are needed to calculate cancer incidence, mortality, prevalence, and survival trends, show distribution of stage at diagnosis and treatments received, help inform and evaluate cancer prevention, control and treatment efforts, and to generate hypotheses for further research.

Despite the importance of cancer registration for producing data needed to inform decisions about cancer control activities, obtaining the resources required to operate and sustain quality registries remains a major challenge in Sub-Saharan Africa, where health priorities compete for limited resources. These challenges are compounded by a lack of information about the resources required to effectively run all the activities essential for cancer registration. Without such evidence, it is difficult to advocate for the funding needed to sustain high quality cancer registration in Kenya.

Kenya is an East African country bordered by the Indian Ocean, Somali, Uganda, Rwanda and Ethiopia. It has three main population-based cancer registries, located in Nairobi, Eldoret, and Kisumu (Fig. 1). These registries are described in Table 1. The Nairobi Cancer Registry was established after consultations between the United States National Cancer Institute (US NCI), the International Agency for Research on Cancer (IARC), the Kenya Ministry of Health, and KEMRI. The establishment of the registry was approved by the Scientific Steering Committee and the Ethics Research Committee of KEMRI and endorsed by the Kenya Ministry of Health and the World Health Organization. The registry has maintained its role as a recognized key player in cancer registration in Africa. By fostering relationships with both local and international cancer control stakeholders, the registry has mobilized resources to maintain its operation. The registry offers technical support to newly established hospital-based and population-based registries in Kenya and facilitates trainings for cancer registries in other parts of Africa in collaboration with the Africa Cancer Registry Network (AFCRN).

The Eldoret Cancer Registry is a population-based cancer registry that operates within the Hemato-Oncology department of Moi University and is located in the same complex as the Moi Teaching and Referral Hospital; it's main source of data. Some of the registry's staff members (such as the Director and the Secretary) are employees of Moi University, and others are volunteers who serve for short time periods. Moi University students occasionally help (as volunteers or are given a small stipend) with data collection from hospitals, pathology laboratories, and registries of vital statistics.

The Kisumu Cancer Registry, which is a population-based cancer registry located within the Kisian Campus of KEMRI in Kisumu, captures unique, well-documented data on HIV-related malignancies; Kaposi Sarcorma and Non-Hodgkins Lymphoma, in addition to the standard cancer registry data.

The aims of this study were to 1. Determine the economic costs of running a cancer registry in Kenya, 2. Understand the factors that affect the collection of high-quality data, and 3. Quantify the costs associated with each activity performed by the registry. The Nairobi Cancer Registry was selected as the main site for the economic evaluation of cancer registration in Kenya, as it is the largest registry and serves as a focal point for increasing cancer registration across the country.

2. Materials and methods

2.1. Nairobi Cancer Registry coverage area

Nairobi is 1 of 47 counties in Kenya and hosts the country's capital city (Fig. 1). It is in the South Central region of the country. The registry covers approximately 696 square kilometers, which is about 0.3% of the total area. It is an urban area with residents from both high and low socioeconomic classes. Nairobi has sizeable populations of Asians, Europeans, and Somalis, making it uniquely representative of Kenya's diverse ethnic groups. The city of Nairobi enjoys the status of a full administrative county. There are eight main administrative divisions (Central, Dagoretti, Embakasi, Kasarani, Kibera, Makadara, Pumwani, and Westlands). The population of Nairobi County was 3,138,639 according to the 2009 National Census [4]. Nairobi County is the largest populated county in Kenya, at about 8.1% of the total country population. The United States Central Intelligence Agency (CIA) estimates that the population of Kenya in 2015 was 45,925,301 with an annual growth rate of 1.93% [5].

2.2. Registry data collection approach and review of data quality

The registry reports data on all residents of Nairobi, defined as anyone who has lived in Nairobi for at least a 6-month period. Cancer registrars are recruited, trained, and deployed to collect data from the different sources used by the registry. The registry uses an active method of case finding and abstraction. This approach is a systematic process by which cancer cases eligible for registration or inclusion in the database are identified. Using an active method approach, employees or volunteers visit the various sources to identify and abstract the relevant information.

In the beginning, the registry collected information on residents and all people referred from other parts of the country for cancer treatment in Nairobi. The amount of data processed was much higher than the incident cases reported, and the workload was substantial. Based on this experience, the data collection process was changed and the registry concentrated on finding only the Nairobi resident cases in the more than twenty facilities that the registry covers.

The data items collected are relatively standard. They include the following:

1. Patient details: First name, given/maiden name, last name (surname), ID number, age/date of birth, gender, concurrent illness, current residence, place (district) of birth, religion, and tribe/ethnicity.

2. Tumor: Incidence date, basis of diagnosis, primary site/topography (ICD-O-3) code, histology/morphology (ICD-O) code, behavior, grade, and stage at diagnosis.

3. Treatment(s): Initial and subsequent treatment modalities: surgery, radiation, chemotherapy and hormonal, and date(s) of treatment

4. Sources of data: Hospital or laboratory name, hospital number, laboratory report number, and date of abstraction.

5. Follow-up: Patient status (alive or dead) at date of incidence; last date of contact with physician/health-care provider or, if dead, date and cause of death; hospice number.

6. Concurrent illness: any concurrent illness is recorded including documentation of HIV status, which began as a pilot study (funded research project). Findings from the pilot study [6] showed that the registry required minimal resources (if any) to collect these additional data hence the registry continued to document HIV as one of its variables.

The process of data collection has been previously described [7]. Government and private hospitals, hospices, hematology and histopathology laboratories, and cancer centers are sources of data. Other sources are comprehensive care centers, outpatient clinics, imaging units, and medical wards. In the hospitals, data were abstracted mainly from medical records departments and radio-therapy units. Pre-designed case registration forms were used to capture data from medical records. Death certificates mentioning cancer were identified in the civil registration of births and deaths and abstracted onto the registration forms. Further checks were subjected to cases abstracted in the civil registrar's office because of known inaccuracies on death certificates. Death certificates were traced back to the clinical records to verify the information. The death certificate notified cases were matched against the registry database, and for cases already registered, status at last contact was updated and the cause of death included. The specific approach used to identify and abstract data from each source is described below:

i. Government and Private Hospitals—Registrars collect data from 26 major hospitals. They use disease index cards and patient-care service registers to identify cancer cases in both inpatient and outpatient departments. A few hospitals have established computer-based disease indices that are also used to identify cancer cases.

ii. Medical Laboratories—Many of the government and private hospitals have specialty laboratories that include histology, hematology, and cytology. Registry staff visit and collect data from 10 laboratories.

iii. Radiotherapy Treatment Centres—The radiotherapy units at Kenyatta National Hospital and Nairobi Hospital provide care for newly diagnosed or recurrence cancer patients who visit these facilities for radiotherapy services.

iv. The Nairobi Hospice—Most of the data from the Nairobi Hospice is on patients referred from Kenyatta National Hospital and the other health care facilities in Nairobi. Cancer registrars visit the hospice to collect up-to-date information on patients' status, which is used for follow-up and case assessment.

v. Vital Statistics Registrar of Births & Deaths (Death Certificates Office)—In 2006, the registry established a link with vital statistics to access cancer-specific mortality data.

Coding of tumor site (topography) and histology (morphology) is done according to International Classification of Diseases for Oncology (ICD-O 3) [8]. The CanReg5 software [9], an open-source tool developed by the IARC designed to input, store, check and analyze

cancer registry data, automatically converts the pairs of topography/morphology codes to the appropriate code in the 10th revision of the International Classification of Diseases (ICD-10) [10]. Multiple primary cancers are defined according to the 2004 IARC rules. Similarly, the registry adheres to IARC guidelines on confidentiality in connection with or during the collection, storage, use, and transmission of identifiable data.

Data management are performed using CanReg5 software [9], which checks for duplicate registrations (as well as the validity and consistency of coded data). Case registration forms that lack sufficient information were put aside for further re-abstraction. Studies on completeness have not been carried out in this registry. However, the registry does review the percentage of morphologically verified cases (MV); uses death certificate clearance to identify Death Certificated Only (DCO) cases; and when data for the same case is obtained from many sources such as: hospitals, the hospice, private clinics and laboratories – allowing for cross verification, these cases may have a higher quality index – all of these procedures are part of the internal quality evaluation process. Though the Nairobi Cancer Registry data did not meet the high-quality standards required for inclusion in *Cancer Incidence in Five Continents* (CI5) volume 10 released in 2014; the data is still being used to give policy makers an idea of the cancer burden in Kenya.

2.3. Cost data collection approach

The Nairobi Cancer Registry was the first low and middle income country registry selected to pilot test the Centers for Disease Control and Prevention's (CDC's) International Registry Costing Tool (*IntRegCosting Tool*) which was based on Excel software with plans to subsequently have a web based tool. A catalogue of registry activities and their definitions was developed in consultation with the registry director and supervisor. The *IntRegCosting Tool* consists of 10 components [11] that were finalized with input from registry staff. Information on labor and non-labor resources were provided for each component and assigned to specific activities. Two rounds of cost data were collected for 2 consecutive fiscal years: July 2012 through June 2013, and July 2013 through June 2014.

3. Calculations

3.1. Reporting of incident cases

We generated numbers of cases registered with incidence dates from January 2012 through December 2013 from the CanReg5 database. We excluded cases registered during the period that had an incidence date outside the 2 years. These estimates would serve as the denominator to calculate the cost per case.

To provide details on overall cancer incidence, we report the top 6 most common cancers for males and females separately using age specific rates per 100,000 for the time period from 2007 to 2011. We also report age-standardized incidence rates for the time period from 2004 to 2008. Age standardization was carried out by the direct method using the "world standard population" [12] to obtain the World age-standardized rate (ASR) per 100,000 populations. We used the 2009 census to generate the population estimates.

3.2. Cost and resource use

We analyzed the cost data using Microsoft Excel. We identified all sources of funding for the cancer registry and cataloged the resources associated with these sources. Most of the sources provided funds directly, which we were able to identify and allocate accurately. The host institution, KEMRI, contributed both through direct transfers (generally salary for selected staff) and through other contributions, such as use of facilities and other administrative processes and equipment (IT support, computers, and printers). The host institution direct transfer payments could be accurately captured, but other in-kind contributions could only be quantified through "best-case estimation."

We allocated labor and non-labor information from the Microsoft Excel–based *IntRegCosting Tool* to specific registry activities. For each registry personnel, we had information on their salary and proportion of time spent on each type of registry activity, which allowed us to allocate cost as well as calculation of full-time equivalents (FTEs). We defined an FTE as a registry staff person who was employed full time and worked 40 h per week. We showed the distribution of the registry's resources by source for round 1 and round 2 data and including in-kind contributions. We estimated the cost by specific cancer registry activities by round, and assessed the number of registry staff FTEs devoted to each type of registry activity, based on the labor amounts reported in the tool.

The sources of funding to support the Nairobi Cancer Registry operations tend to vary from year to year, and therefore, we collected sources of funding and cost of operations over a 2-year time period. We present the sources of data combined across the 2 years and show activities and FTEs by year to identify variation in the resources expended on operations

4. Results

The Nairobi Cancer Registry records approximately 1870 incident cases for any given year of diagnosis. These data reflect the incidence per year, not the number potentially abstracted and processed. The number of cases collected varies year to year depending on the resources available for cancer registration. Furthermore, case registration forms missing key information, such as date of diagnosis, are set aside without being entered into the registry database and are returned to the registrars for re-abstraction and validation. As indicated earlier, the Nairobi Cancer Registry does not have a continuous source of funding. In times of limited funding, case abstraction and processing slows causing a back log followed by an eventual catch-up with increased registrations when funds become available. For example, the registry processed 8381 cases during annual period 2012–2013, and 2000 cases in 2013–2014.

There were several factors observed that would affect the collection of high quality data. These include access of registry staff to data source filing areas, storage of data and filing procedures at data sources; documentation of patient and disease information by healthcare workers at provider sites; and staff availability compared to the number of data sources/work load. Additional challenges are also relate to retaining trained staff as inadequate compensation results in high turnover.

Despite the challenge of discontinuous funding, the Nairobi Cancer Registry has been able to produce cancer incidence data since the year 2000 to inform the planning of cancer prevention and control activities in Kenya. Fig. 2 presents the crude age-specific incidence rates per 100,000 population for the period 2007–2011 for both males and females. As expected, older age groups have higher incidence rates than younger individuals but there are differences between males and females. Cancers experienced by men (especially prostate cancer) have an increasing incidence as one ages while cancers diagnosed among women (specifically breast and cervical) peak at about age 40 to 50 years and then decline. Prostate cancer was the top cancer in men with an age-standardized incidence rate of 40.6 per 100,000 (not shown in figure). Breast cancer was the most common cancer among women followed by cervical cancer. Breast cancer has an age-standardized incidence rate of 51.7 per 100,000 and cervical cancer has an age-standardized incidence rate of 46.1 per 100,000 [7].

Fig. 3a and b provides the sources of funding for the registry over each period, from July 2012 through June 2013 and July 2013 through June 2014. Funding from grants; research studies; and international organizations, including the IARC, AFCRN, and International Network for Cancer Treatment and Research (INCTR), accounted for about 70% of the registry operations' cost. The other approximately 30% was supported by host institution contributions from KEMRI. AFCRN is partly funded by CDC, through a grant to support cancer registration, via the IARC. Specific grants and research studies varied between the years, although altogether they made up about 33% of the funding in both rounds. The IARC contribution increased from 3% in the first annual period to 27% of the total in the second annual period. Funding is received for general cancer registry operations as well as specific studies and therefore the type of activities that the registry staff perform at specific times will vary. Appendix A Table A1 presents the detailed funding amounts by source.

Fig. 4 presents the distribution of registry resources by budget category as an average of total resources from July 2012 through June 2014. Labor used the largest amount of resources, with 56%, while computers, travel, training, and other materials used 30% of the registry resources. Indirect, administrative, and software used 9% of the registry resources while consultants used the smallest amount of resources, 5%

Fig. 5 presents the distribution of cost and FTEs by registry activities for two annual periods. In both time periods, the most costly registry activities were related to registry administration, management, and training along with data acquisition activities such as data abstraction, entry, and validation. The years substantially differed in terms of the data collection and management activities, likely reflecting the prioritization of resources during the annual period. Training costs also showed large variation between the two years; this includes training received by staff both locally and outside the country. Travel costs associated with training are likely the reason for the difference between the years, as there is not much difference in FTEs or staff time, as shown in Fig. 5b. Other activities with significant differences in labor hours between the years included data abstraction and data entry. For example, in the first year, 2.5 FTEs performed data entry, whereas in the second year, only about 0.5 FTEs were used. Similarly, data abstraction differed by about 1.5 FTE between the 2 years.

5. Discussion

Over the 2-year period between July 2012 and June 2014, more than two-thirds of the funding for the Nairobi Cancer Registry came from research grants, the IARC, and AFCRN. Support from KEMRI, the host institution, covered only about a third of the total registry expenditure. Although grants for specific research studies were an important source of funding for cancer registration, more stable sources of funding are necessary to ensure adequate funds are consistently available across years. To develop quality registries, sustained investment in infrastructure is needed.

Cost expended on registry activities varied substantially between the 2 years on the basis of the availability of funding to support specific registration activities. A 2014 study reported approximately US $ 8–9 in direct funding per case registered for countries in sub-Saharan Africa [13]. The registry has numerous data sources that need to be visited on a regular basis, and data collection activities vary by source and requires staff expertise to work with a variety of sources and inputs. The Nairobi registry has faced numerous challenges over the past few years, especially limited funding, which has hindered their ability to hire full-time staff to maintain consistency in registry operations. The registry has engaged volunteers on short-term assignments or contracted staff when funding is available. Therefore, there is high staff turnover. The registry routinely loses much of its experienced staff and needs to constantly train new staff, which increases the resources required for training. In 2012–2013, funding was not sufficient to compensate contracted staff to collect data at the reporting sites. This resulted in delays in data collection and increased the time taken to report complete data. However, with a prevailing focus on data entry, resources for data entry increased hence the high number of registrations. The significant variations in FTEs by activity may also be because different research grants have different requirements. This study shows the importance of analyzing both overall cost and labor resources to obtain a more-comprehensive assessment of registry operations. Institutional and external support that can offer stable funding for cancer registration is needed to operate high-quality registries in Kenya. Grants, although an unstable source of funding, require the cancer registry to perform core registry activities to achieve results or fulfill the deliverable, which goes towards benefitting the overall operations of the registry, albeit disproportionately. For example, follow up studies to determine survival of cancer patients from one or a group of cancers, requires registry staff to conduct case finding and abstraction (core activities of the registry) to identify patients that need to be followed up to ascertain their status.

A quality and needs assessment was undertaken in April 2015 in the existing registries in Kenya with support from the US NCI. This entailed evaluating the performance and needs of each of the three registries (Nairobi, Eldoret, Kisumu) and determining the steps needed to broaden data capture and improve quality. The needs assessment highlighted the limited number of staffing in the three registries. The US NCI committed to support the three registries for a five-year period in a phased-funding approach with the host institutions being urged to commit additional resources for continuity of the registries. Adequate compensation for personnel is essential for continuity and sustainability of registry operations.

Given the strategic location of the Nairobi Cancer Registry—which is based in the capital, along with Kenya's major cancer treatment centers, oncologists, and the headquarters of KEMRI—stakeholders have proposed that the Nairobi Cancer Registry be scaled up to a National Cancer Registry Program that will collect and report data from population-based cancer registries in Kenya. The National Cancer Registry Program was launched in February 2016 and the government of Kenya has provided seed funds to start up the program. It is anticipated that local and international partners will join in supporting the program. The establishment of the National Cancer Registry Program was necessitated by demand from the county governments interested in developing registries to understand the burden of cancer in their counties. In addition, the cancer registry track during a stakeholders meeting held in 2014 noted that there was need to increase the coverage of cancer registration in Kenya by strengthening the existing registries, expanding to other regions of Kenya and merging the data in a centralized database. As a national body responsible for carrying out health research in Kenya and the experience of maintaining a population-based registry, KEMRI was proposed as the host of the registry and will collaborate with the Kenya Ministry of Health and National Cancer Institute of Kenya to oversee all cancer-related activities in the country. The national registry program will be responsible for ensuring use of standardized data collection tools and developing and implementing a cancer registry awareness program targeting hospital staff (chief executive officers, medical superintendents, oncologists, pathologists, clinicians) with a goal of improving documentation of medical information so that data quality improves. The national registry program will also support the establishment of additional registries in Kenya by providing technical support, training of staff, data collection from all population-based registries, and reports on cancer burden that will be used for further research and to inform cancer prevention, management and control. The costing analysis presented in this study served as a valuable resource for understanding the economics of operating cancer registries, provided guidance for approaches to integrate and expand the activities of the existing registries in an efficient manner, and serves as a baseline to assess progress. For example, the economic evaluation has spearheaded much-needed discussion on which registry tasks need to be centralized versus decentralized to create an efficient network of national registration in Kenya.

Although we have made substantial effort to obtain accurate cost and resource use data, several limitations need to be highlighted. First, the two annual periods of data analyzed showed large variation. Therefore, many more years of data may be required to see consistent patterns in the cost of specific activities and the cost per case. Second, the distribution of resources under stable and adequate funding for registry activities may result in a different distribution of resources to registry activities. We hope to be able to study this in the future when the National Cancer Registry Program is fully established in Kenya. Third, although we have assessed factors internal to the registry that are likely to affect the cost of operations, we did not systematically assessed external factors. For example, the number of reporting facilities and quality of data maintained at these facilities was not assessed. Furthermore, even though cancer is a reportable disease in Kenya, compliance with reporting is low, which poses additional challenges. These external factors and their impact

on cost and data quality need to be studied in detail to inform the optimal approaches as cancer registration is scaled up in Kenya.

6. Conclusions

Information collected by cancer registries is valuable to researchers, policy makers, and public health officials for purposes of planning and evaluating cancer control programs and interventions along the continuum of care from prevention, to screening, to diagnosis, and to treatment. The data generated from cancer registries also provide an essential platform where additional in-depth research analysis can be launched. Therefore, cancer registration is an essential activity that needs adequate support to ensure accurate and complete data.

The economic study of the Nairobi Cancer Registry has provided valuable information on resources needed to run a cancer registry and has highlighted the variation in resources expended on registration activities across the two annual periods studied. The cancer registry does not have continuous funding to maintain registry operations, and therefore, it must rely on research funding and other contributions that may be available only for a given time period. The inconsistent registry funding results in discontinuity of registration activities and high staff turnover, which impacts both training costs and quality of the data. Stable funding for cancer registry operations in Kenya is therefore essential to deliver the high-quality data necessary to implement evidence-based policies to improve cancer outcomes. As stakeholders look into expanding the Nairobi Cancer Registry into a national program, the cost data provided in this study will be useful in justifying the funding required for sustaining and expanding registry activities.

Acknowledgments

Abbreviations

AFCRN	Africa Cancer Registry Network
ASR	age-standardized rate
CDC	Centers for Disease Control and Prevention
CI5	Cancer Incidence in Five Continents
CIA	Central Intelligence Agency
FTE	full-time equivalent
IARC	International Agency for Research on Cancer
ICD-O	International Classification of Diseases for Oncology
IntRegCosting Tool	International Registry Costing Tool

INCTR	International Network for Cancer Treatment and Research
IT	information technology
KEMRI	Centre for Clinical Research at Kenya Medical Research Institute
LMIC	low- and middle-income country

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Appendix A

Table A1

Nairobi Cancer Registry Total Resources by Source, U.S. Dollars.

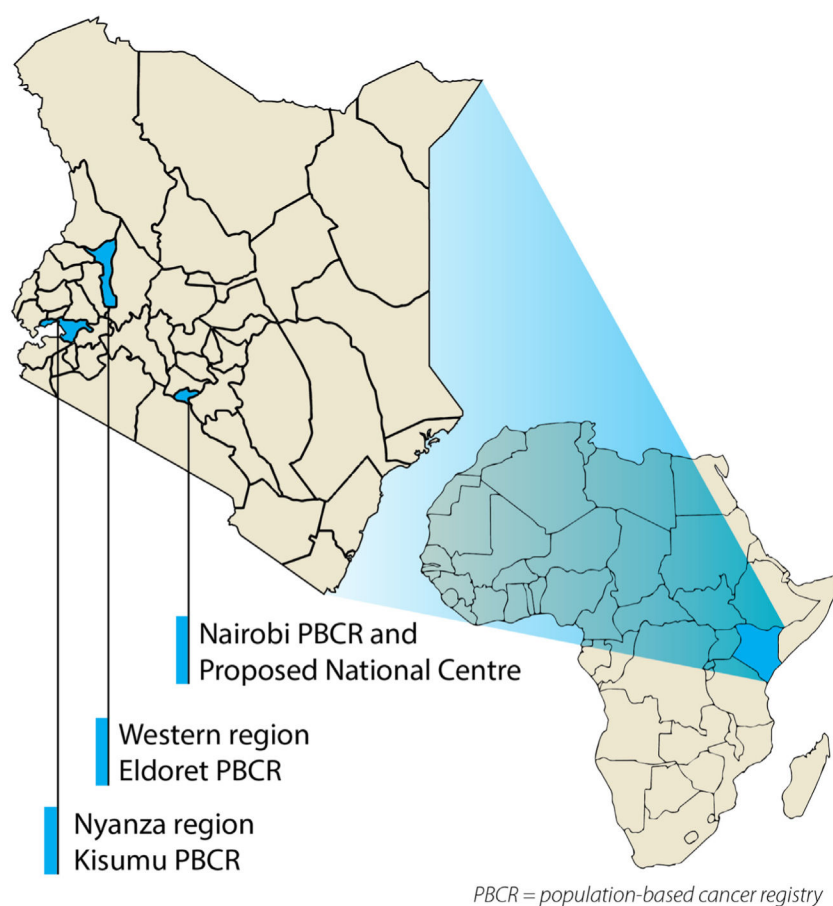|	July 2012–June 2013	July 2013–June 2014
Kenya Medical Research Institute (KEMRI)	26,317	30,388
African Registry Network (AFCRN)	26,281	12,414
International Agency for Research on Cancer (IARC)	2667	28,448
Grants/Other Research Studies	27,440	35,779
Total Funding	82,705	107,029

Note: 1 U.S. Dollar = 87 Kenyan Shillings in 2014.

Fig. 1.
Map of Kenya showing the location of the Nairobi, Kisumu, and Eldoret Cancer Registries.

a. Males

b. Females

Fig. 2.
Nairobi county age-specific incidence rates per 100,000 population, 2007–2011.
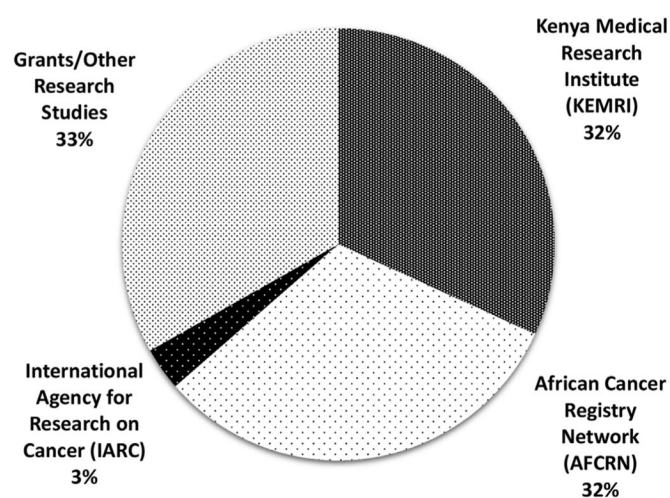
a. Males

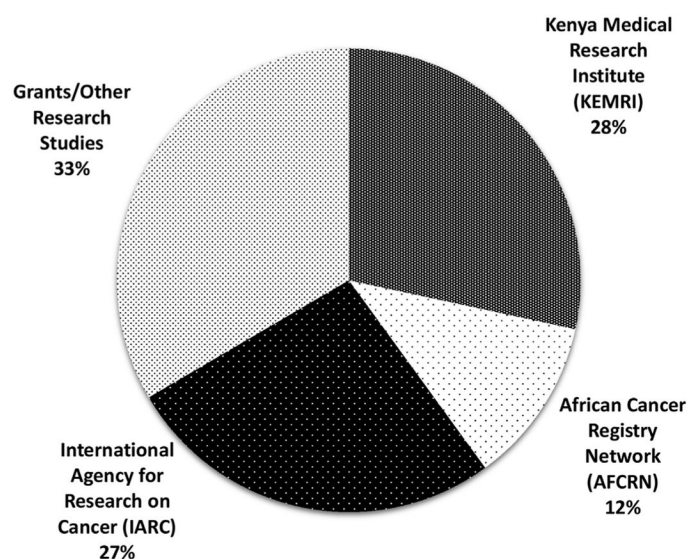*Note*: Mouth includes oral cavity and pharynx

b. Females

Note: Mouth includes oral cancer and pharynx

a. July 2012–June 2013

b. July 2013–June 2014

Fig. 3.
Nairobi Cancer Registry Distribution of Total Resources by Source.
a. July 2012–June 2013
Note: Kenya Medical Research Institute (KEMRI) operates as the host institution for the Nairobi Cancer Registry. AFCRN is partly funded by CDC, through a grant to support cancer registration, via the IARC.
b. July 2013–June 2014

Note: Kenya Medical Research Institute (KEMRI) operates as the host institution for the Nairobi Cancer Registry. AFCRN is partly funded by CDC, through a grant to support cancer registration, via the IARC.
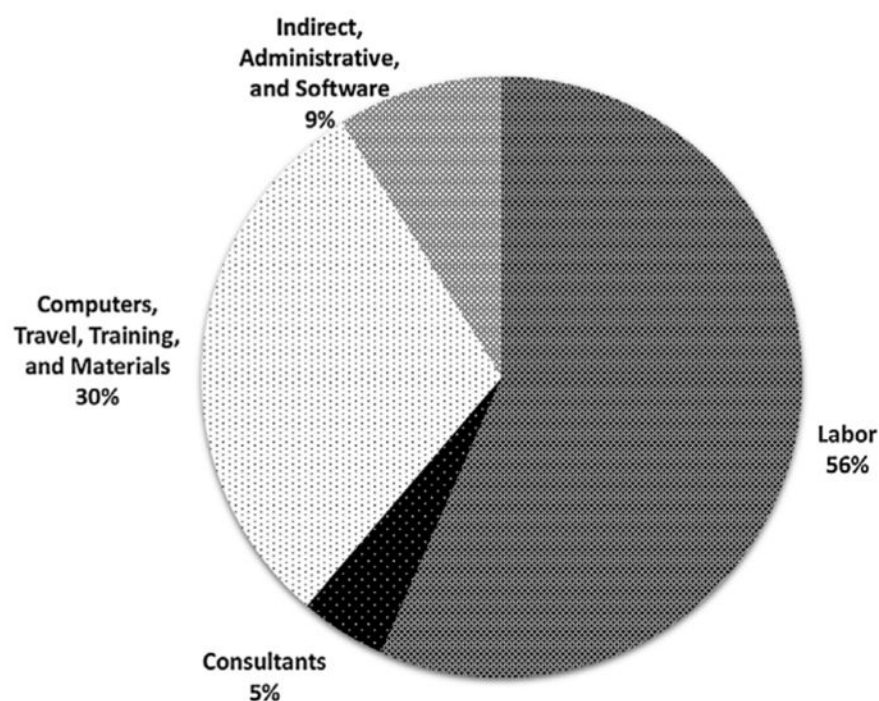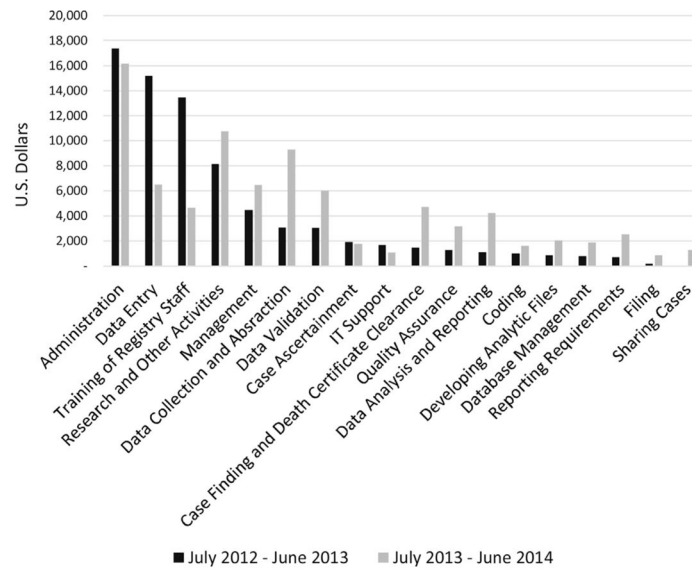
Fig. 4.
Nairobi Cancer Registry Resources by Budget Category, July 2012–June 2014.
Note: We show the average cost results using data collected for July 2012–June 2014.

a : Nairobi Cancer Registry Costs by Activity (Kenyan Shillings) for the two
rounds of data collection

b : Nairobi Cancer Registry Full-time equivalents (FTEs) by Activity for the two
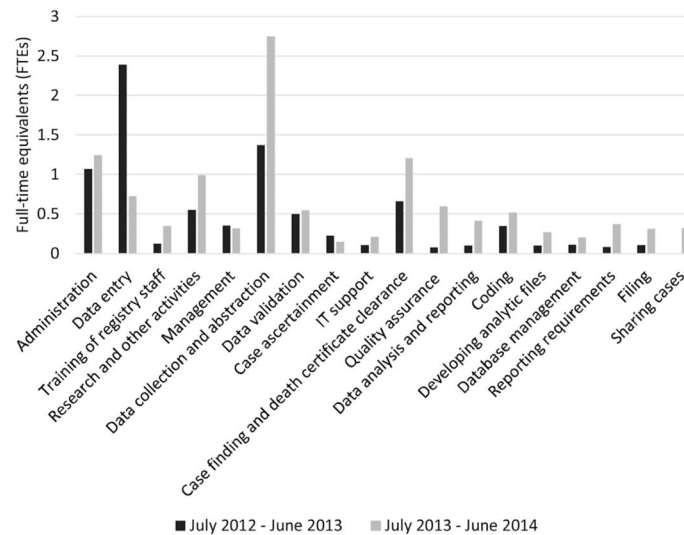rounds of data collection.

Fig. 5.
(a) Nairobi Cancer Registry Costs by Activity (Kenyan Shillings) for the two rounds of data collection. (b) Nairobi Cancer Registry Full-time equivalents (FTEs) by Activity for the two rounds of data collection.
Note: 1 U.S. Dollar = 87 Kenyan Shillings in 2014.

Table 1

Description of three population based cancer registries in Kenya.

Name of the Cancer Registry	Year of Establishment	Location	Geographical Coverage	Population Covered (2009 Census)
Nairobi Cancer Registry	2001	Kenya Medical Research Institute (*Centre of Clinical Research*)—Nairobi	Nairobi County—696 square kilometres	3,138,639
Eldoret Cancer Registry	1998	Moi University (*Department of Haematology & Blood Transfusion*)—Eldoret	Uasin Gishu County— 3345.2 square kilometres	894,179
Kisumu Cancer Registry	2010	Kenya Medical Research Institute (*Centre for Global Health Research*)—Kisumu	Kisumu County—2085.9 square kilometres	968,909